1st Semester Diploma Engineering Exam., 2016

ENGINEERING PHYSICS—I AND ENGINEERING CHEMISTRY—I

Paper : EPC–102

Full Marks : 70

Time : 3 hours

The figures in the margin indicate full marks for the questions

FIRST HALF

(Engineering Physics—I)

Answer Question No. **1** and *any* **three** from the rest

1. Choose the correct option (any *eight*) :   1×8=8

   (a) Which of the following pairs has the same dimension?

   (i) Pressure and work done

   (ii) Momentum and velocity

   (iii) Stress and longitudinal strain

   (iv) Stress and Young's modulus

   (b) 1 parsec is equal to

   (i) 2·26 light years

   (ii) 3·26 light years

   (iii) 4·26 light years

   (iv) None of the above

(*Turn Over*)

(c) The displacement vs. time graph of a particle in motion is parallel with the time axis. The velocity of the particle is

  (i) increasing with time

  (ii) decreasing with time

  (iii) zero

  (iv) having a non-zero constant value

(d) Two forces F_1 newton and F_2 newton are acting simultaneously on a body of mass m kg but the velocity of the body remains unchanged. The resultant force on the body is

  (i) zero

  (ii) $(F_1 + F_2)$ newton

  (iii) $(F_1 - F_2)$ newton

  (iv) None of the above

(e) A force F is applied on a body of mass M which is kept on a wooden floor. The force of friction generated is f. The angle between F and f is

  (i) 180°

  (ii) 90°

  (iii) 45°

  (iv) 0°

(*Continued*)

(f) $\vec{A}$ and $\vec{B}$ are parallel to each other. Which of the following conditions is true?

(i) $\vec{A} \cdot \vec{B} = 0$

(ii) $\vec{A} \cdot \vec{B} = 1$

(iii) $\vec{A} \times \vec{B} = 0$

(iv) $\vec{A} \times \vec{B} = 1$

(g) The escape velocities of two bodies of mass 10 kg and 100 kg on the surface of earth are V_{10} and V_{100} respectively. Then

(i) $V_{10} < V_{100}$

(ii) $V_{10} > V_{100}$

(iii) $V_{10} = V_{100}$

(iv) None of the above

(h) A normal deforming force F is applied on a wire having area of cross-section A. As a result, the wire is stretched to double its length. The expression of Young's modulus in this case is

(i) $Y = F/2A$

(ii) $Y = 2F/A$

(iii) $Y = F/A$

(iv) None of the above

(4)

(i) Action and reaction do not balance each other because they

    (i) act on the same body

    (ii) do not act on the same body

    (iii) are in opposite direction

    (iv) are not equal

(j) Newton's formula for the speed of sound in gas is

    (i) $V = \sqrt{P/\rho}$

    (ii) $V = \sqrt{P\rho}$

    (iii) $V = \sqrt{\gamma P/\rho}$

    (iv) $V = \sqrt{\gamma P}$

2. *(a)* Are all constants dimensionless? Give example in support of your answer.

  (b) Find the dimensions of a and b in the equation

$$E = (b - x^2)/at$$

where E is energy, x is displacement and t is time.

             (Continued)

(c) The centripetal force is given by

$$F = \left(\frac{mv^2}{r} \right)$$

The mass (m), velocity (v) and radius (r) of the circular orbit of an object after calculating errors are found to be
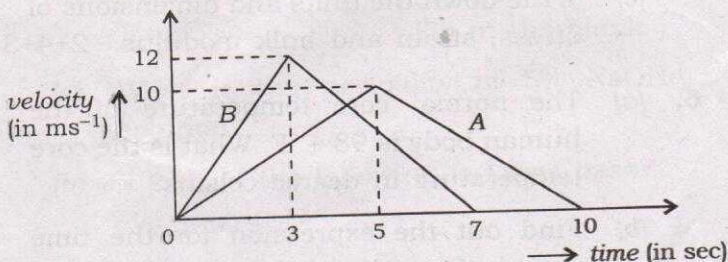
$$m = (0 \cdot 5 \pm 0 \cdot 005) \, \text{kg}$$
$$v = (10 \pm 0 \cdot 01) \, \text{ms}^{-1}$$
$$r = (0 \cdot 4 \pm 0 \cdot 01) \, \text{m}$$

Calculate the percentage error in force.

2+3+4=9

3. (a) A ball is thrown straight up. What are its velocity and acceleration at the top?

(b) The velocity vs. time graph of two objects A and B are as shown in the figure :

(i) Which object is having higher acceleration between 0 to 3 seconds?

(ii) Which object covers more distance?

(Turn Over)

(c) Find the angle between $\vec{A} = 3\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{B} = 5\hat{i} - 2\hat{j} - 3\hat{k}$.   2+4+3=9

4. (a) State the principle of conservation of momentum. Using this, find the expression of recoil velocity of a gun.

(b) Draw a graph showing the variation of frictional force with applied force.

(c) Prove that everybody losses their weight at the centre of earth.   4+2+3=9

5. (a) What do you mean by zero work? Give an example.

(b) State the principle of conservation of mechanical energy. Show that this principle holds good for a body falling freely under gravity.

(c) Write down the units and dimensions of stress, strain and bulk modulus.   2+4+3=9

6. (a) The normal core temperature of the human body is 98·4 °F. What is the core temperature in degree celsius?

(b) Find out the expression for the time period of simple pendulum.

(c) Write down the effect of temperature and humidity on the velocity of sound.

                                    4+3+2=9

                          (Continued)

(7)

(Engineering Chemistry—I)

Answer Question No. **7** and *any* **three** from the rest

7. Answer as directed any *eight* of the following :

$$1 \times 8 = 8$$

(a) Define buffer solution.

(b) What is alloy steel?

(c) What is the oxidation number of P in PO_4^{3-}?

(d) Write down the electronic configuration of Fe^{+2} ion.

(e) Write the general formula of alkene homologous series.

(f) Ionic compounds have _____ melting point.

(Fill in the blank)

(g) What is the normality of 5% NaOH solution?

(h) Which of the following is Lewis base?

(i) NaOH

(ii) BF_3

(iii) NH_3

(iv) NH_4Cl

(Choose the correct option)

(Turn Over)

(i) High boiling point of water is due to

    (i) ionic bond

    (ii) H-bond

    (iii) covalent bond

    (iv) coordinate bond

         (Choose the correct option)

(j) State the octet rule.

8. (a) State Faraday's First Law of electrolysis. How do we get the definition of electrochemical equivalent from the First Law of Faraday?

(b) What is acid-base indicator? Which indicator is suitable for the titration between CH_3COOH and NaOH and why?

(c) Balance the following equation by ion-electron method :

$$MnO_4^- + S^{2-} + H^+ \rightarrow Mn^{2+} + S + H_2O$$

$$(1+2)+(1+2)+3$$
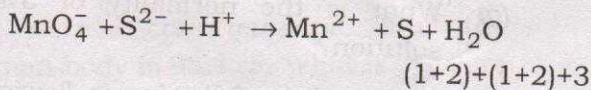
9. (a) What are the main drawbacks of Rutherford's atomic model?

(b) What is Aufbau principle? Explain why the electronic configuration of Cr is $[Ar]^{18} 3d^5 4s^1$ and not $[Ar]^{18} 3d^4 4s^2$.

(c) Give the significance of each quantum number. What are the values of l and m for the electrons in $4P$ orbital?

$$2+(1+2)+(2+2)=9$$

10. (a) Write any three characteristics of covalent compounds.

(b) Explain the following with proper reason :

(i) NaCl has high melting point

(ii) Graphite is a good conductor of electricity

(c) According to VSEPR theory, what are the shape and bond angle of NH_3 molecule? $3+(2+2)+2=9$

11. (a) How is steel manufactured by Bessemer converter process? Explain by giving the chemical reactions.

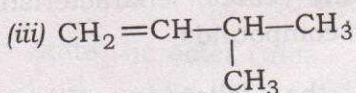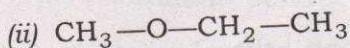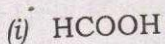(b) What is the function of fluorspar in aluminium extraction?

(c) Write down the name and formula of one ore of copper.

(d) Write down the percentage of alloying metal in gun metal. $4+2+2+1=9$

(**10**)

12. (a) Give the IUPAC nomenclature of the following :

    (i) HCOOH

    (ii) $CH_3—O—CH_2—CH_3$

    (iii) $CH_2=CH—CH—CH_3$
                  CH_3

(b) Write short notes on the following :

    (i) Tautomerism

    (ii) Functional group

(c) Explain the tetracovalency of carbon.

$$(1+1+1)+(1½+1½)+3=9$$

★★★